

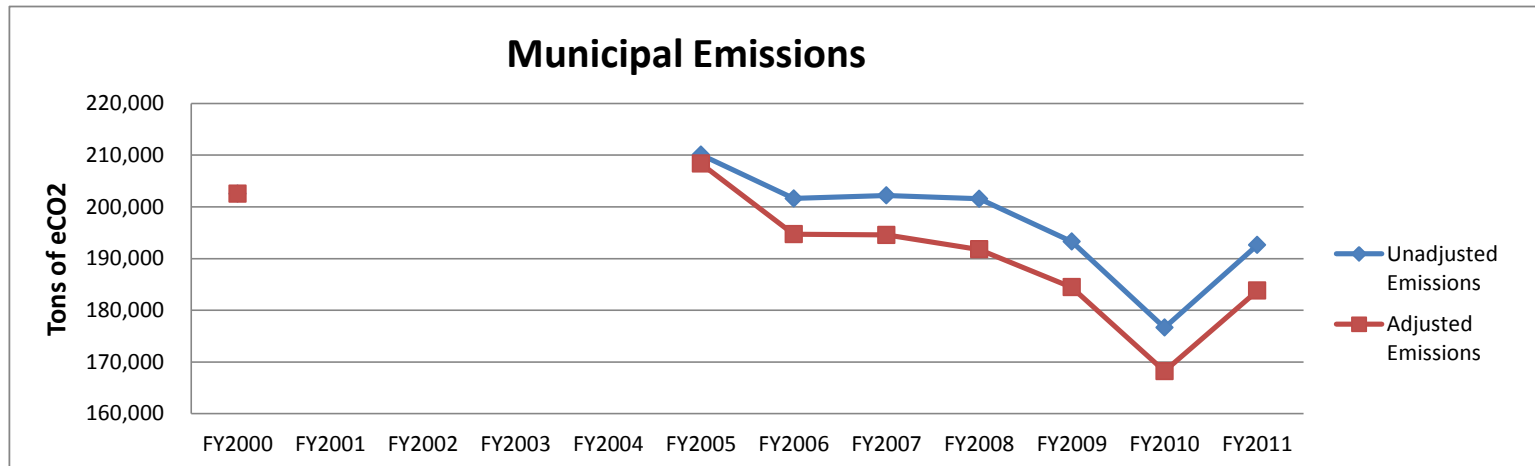
Boston Municipal Greenhouse Gas Inventories

1. Summary of GHG Emissions
2. Municipal GHG Emissions FY2005–FY2011
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City of Boston Municipal Greenhouse Gas Emissions Summary
(CO2 tons equivalent)

	FY2005	FY2006	FY2007	FY2008	FY2009	FY2010	FY2011
Electricity	97,526	92,052	90,491	93,302	85,981	77,357	76,416
Natural gas	58,396	56,708	59,899	58,841	58,901	54,183	70,064
Diesel	21,427	21,079	22,631	22,633	23,500	21,494	22,709
Gasoline	15,078	15,590	16,271	15,987	15,151	15,187	13,898
Light fuel oil	7,502	7,329	5,950	4,945	4,797	4,227	4,574
Steam	9,845	8,640	6,733	5,677	4,784	4,038	4,784
Propane	289	216	198	171	158	152	149

Unadjusted Emissions	210,063	201,614	202,173	201,556	193,272	176,638	192,594
Adjustments	1,708	6,914	7,613	9,803	8,843	8,445	8,819
Adjusted Emissions	208,355	194,700	194,560	191,754	184,429	168,193	183,775



FY2011 City of Boston Municipal GHG Emissions - in Equivalent CO₂ Tons

Fiscal Year

<u>Scope 1 And 2 Departments</u>	SCOPE 1				SCOPE 2		<u>Total Dept. eCO₂</u>	<u>% of Total</u>
	Nat. Gas	Lt. Fuel Oil	Gasoline	Diesel	Electricity	Steam		
Arts, Tourism, & Events	292	-	7	-	224	-	523	0%
Boston Public Schools	44,784	77	341	15,985	18,611	-	79,797	41%
Center for Youth and Families	3,207	-	114	15	1,617	-	4,953	3%
Fire	2,870	251	349	2,291	2,436	-	8,197	4%
Graphic Arts	-	-	-	-	-	-	0	0%
Inspectional Services	-	-	144	6	237	-	387	0%
Library	1,081	-	42	-	5,529	3,180	9,831	5%
Neighborhood Development	261	90	31	-	86	-	469	0%
Parks and Recreation	433	316	525	690	1,616	-	3,580	2%
Police	3,046	316	8,302	39	4,798	-	16,501	9%
Property & Construction Mgmt	2,232	195	254	45	6,665	1,604	10,995	6%
Public Works	2,349	145	1,452	1,405	1,635	-	6,986	4%
Public Works - Streetlights	4,852	-	-	-	27,220	-	32,072	17%
Transportation	250	14	1,028	333	313	-	1,937	1%
Emergency Medical Services	300	-	241	1,165	184	-	1,891	1%
Public Health Commission	2,856	3,170	327	26	3,507	-	9,886	5%
Water and Sewer Commission	1,401	-	742	709	1,737	-	4,589	2%
Subtotal	70,213	4,574	13,898	22,709	76,416	4,784	192,594	100%

ADJUSTMENTS and TOTALS

Scope 1 Total	111,394
Scope 1 Adjustments	115
Scope 1 Adjusted Total	111,279
Scope 2 Total	81,200
Scope 2 Adjustments	8,705
Scope 2 Adjusted Total	72,495
Scope 1+2 ADJUSTED TOTAL	183,775

<u>GHGs by Sector*</u>	<u>eCO₂</u>	<u>%</u>
Buildings	123,915	64%
Transportation	36,607	19%
Streetlights	32,072	17%

*unadjusted

<u>GHGs by Fuel*</u>	<u>eCO₂</u>	<u>% of Total</u>
Electricity	76,416	40%
Natural gas	70,213	36%
Diesel	22,709	12%
Gasoline	13,898	7%
Light Fuel Oil	4,406	2%
Steam	4,784	2%
Propane	152	0.08%

*unadjusted

SCOPE 3

MWRA (Boston share)

<u>Nat. Gas</u>	<u>Lt. Fuel Oil</u>	<u>Gasoline</u>	<u>Diesel</u>	<u>Electricity</u>	<u>Steam</u>	<u>Subtotal</u>
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FY2010 City of Boston Municipal GHG Emissions - in Equivalent CO₂ Tons

Fiscal Year

<u>Scope 1 And 2 Departments</u>	SCOPE 1				SCOPE 2		<u>Total Dept. eCO₂</u>	<u>% of Total</u>
	Nat. Gas	Lt. Fuel Oil	Gasoline	Diesel	Electricity	Steam		
Arts, Tourism, & Events	239	-	5	-	189	-	433	0%
Boston Public Schools	34,092	44	349	15,022	19,313	-	68,819	39%
Center for Youth and Families	2,758	-	114	5	1,643	-	4,520	3%
Fire	2,033	213	714	2,205	2,380	-	7,545	4%
Graphic Arts	189	-	-	-	81	-	270	0%
Inspectional Services	-	-	267	12	237	-	516	0%
Library	1,044	-	31	-	6,072	2,878	10,024	6%
Neighborhood Development	140	-	30	-	60	-	230	0%
Parks and Recreation	356	262	529	759	1,688	-	3,595	2%
Police	2,376	371	8,701	46	4,772	-	16,265	9%
Property & Construction Mgmt	659	193	531	45	5,823	1,160	8,411	5%
Public Works	1,953	135	1,454	1,196	1,882	-	6,619	4%
Public Works - Streetlights	4,852	-	-	-	27,997	-	32,849	19%
Transportation	188	9	1,109	316	305	-	1,927	1%
Emergency Medical Services	257	-	242	1,061	219	-	1,779	1%
Public Health Commission	2,470	2,999	341	18	2,838	-	8,666	5%
Water and Sewer Commission	730	-	771	809	1,858	-	4,168	2%
Subtotal	54,335	4,227	15,187	21,494	77,357	4,038	176,638	100%

ADJUSTMENTS and TOTALS

Scope 1 Total	95,243
Scope 1 Adjustments	54
Scope 1 Adjusted Total	95,189
Scope 2 Total	81,395
Scope 2 Adjustments	8,391
Scope 2 Adjusted Total	73,004
Scope 1+2 ADJUSTED TOTAL	168,193

<u>GHGs by Sector*</u>	<u>eCO₂</u>	<u>%</u>
Buildings	107,108	61%
Transportation	36,681	21%
Streetlights	32,849	19%

*unadjusted

<u>GHGs by Fuel*</u>	<u>eCO₂</u>	<u>% of Total</u>
Electricity	77,357	44%
Natural gas	54,335	31%
Diesel	21,494	12%
Gasoline	15,187	9%
Light Fuel Oil	4,059	2%
Steam	4,038	2%
Propane	155	0.09%

*unadjusted

SCOPE 3

MWRA (Boston share)

<u>Nat. Gas</u>	<u>Lt. Fuel Oil</u>	<u>Gasoline</u>	<u>Diesel</u>	<u>Electricity</u>	<u>Steam</u>	<u>Subtotal</u>
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FY2009 City of Boston Municipal GHG Emissions - in Equivalent CO₂ Tons

Fiscal Year

<u>Scope 1 And 2 Departments</u>	SCOPE 1				SCOPE 2		<u>Total Dept. eCO₂</u>	<u>% of Total</u>
	Nat. Gas	Lt. Fuel Oil	Gasoline	Diesel	Electricity	Steam		
Arts, Tourism, & Events	257	-	6	-	188	-	451	0%
Boston Public Schools	36,458	42	355	16,233	22,977	-	76,065	39%
Center for Youth and Families	2,860	-	113	4	1,751	-	4,728	2%
Fire	2,933	280	758	2,154	2,405	-	8,530	4%
Graphic Arts	213	-	6	-	79	-	298	0%
Inspectional Services	-	-	143	15	250	-	408	0%
Library	988	53	53	-	7,133	3,142	11,369	6%
Neighborhood Development	-	-	31	-	43	-	74	0%
Parks and Recreation	393	302	554	688	1,678	-	3,615	2%
Police	2,580	428	8,798	45	4,970	-	16,821	9%
Property & Construction Mgmt	769	258	270	42	7,226	1,642	10,207	5%
Public Works	2,104	157	1,581	2,020	1,748	-	7,610	4%
Public Works - Streetlights	4,855	-	-	-	29,319	-	34,174	18%
Transportation	209	14	1,090	368	231	-	1,912	1%
Emergency Medical Services	285	-	358	937	227	-	1,807	1%
Public Health Commission	3,177	3,263	289	98	3,475	-	10,302	5%
Water and Sewer Commission	978	-	746	896	2,281	-	4,901	3%
Subtotal	59,059	4,797	15,151	23,500	85,981	4,784	193,272	100%

ADJUSTMENTS and TOTALS

Scope 1 Total	102,507
Scope 1 Adjustments	138
Scope 1 Adjusted Total	102,369
Scope 2 Total	90,765
Scope 2 Adjustments	8,705
Scope 2 Adjusted Total	82,060
Scope 1+2 ADJUSTED TOTAL	184,429

<u>GHGs by Sector*</u>	<u>eCO₂</u>	<u>%</u>
Buildings	120,447	62%
Transportation	38,651	20%
Streetlights	34,174	18%

*unadjusted

<u>GHGs by Fuel*</u>	<u>eCO₂</u>	<u>% of Total</u>
Electricity	85,981	44%
Natural gas	59,059	31%
Diesel	23,500	12%
Gasoline	15,151	8%
Light Fuel Oil	4,639	2%
Steam	4,784	2%
Propane	158	0.08%

*unadjusted

<u>SCOPE 3</u>	<u>Nat. Gas</u>	<u>Lt. Fuel Oil</u>	<u>Gasoline</u>	<u>Diesel</u>	<u>Electricity</u>	<u>Steam</u>	<u>Subtotal</u>
Boston Housing Authority	62,487	9,256			41,442		113,185
MWRA (Boston share)	1,005	3,569	372	386	22,691		28,023

FY2008 City of Boston Municipal GHG Emissions - in Equivalent CO₂ Tons

Fiscal Year

<u>Scope 1 And 2 Departments</u>	SCOPE 1				SCOPE 2		<u>Total Dept. eCO₂</u>	<u>% of Total</u>
	Nat. Gas	Lt. Fuel Oil	Gasoline	Diesel	Electricity	Steam		
Arts, Tourism, & Events	-	-	4	-	141	-	145	0%
Boston Public Schools	36,950	48	368	16,244	26,861	-	80,471	40%
Center for Youth and Families	2,844	-	126	1	1,734	-	4,705	2%
Fire	3,089	228	849	2,154	2,528	-	8,848	4%
Graphic Arts	234	-	6	-	90	-	330	0%
Inspectional Services	-	-	170	11	272	-	453	0%
Library	1,005	197	56	-	8,166	3,748	13,172	7%
Neighborhood Development	-	-	33	-	43	-	76	0%
Parks and Recreation	400	250	549	618	1,807	-	3,624	2%
Police	2,451	383	9,284	54	5,069	-	17,241	9%
Property & Construction Mgmt	749	176	305	34	7,844	1,929	11,037	5%
Public Works	2,167	129	1,694	1,326	1,882	-	7,198	4%
Public Works - Streetlights	4,855	-	-	-	30,553	-	35,408	18%
Transportation	181	15	1,070	363	296	-	1,925	1%
Emergency Medical Services	277	-	385	809	227	-	1,698	1%
Public Health Commission	3,097	3,519	306	123	3,665	-	10,710	5%
Water and Sewer Commission	713	-	782	896	2,124	-	4,515	2%
Subtotal	59,012	4,945	15,987	22,633	93,302	5,677	201,556	100%

ADJUSTMENTS and TOTALS

Scope 1 Total	102,577
Scope 1 Adjustments	128
Scope 1 Adjusted Total	102,449
Scope 2 Total	98,979
Scope 2 Adjustments	9,675
Scope 2 Adjusted Total	89,304
Scope 1+2 ADJUSTED TOTAL	191,754

<u>GHGs by Sector*</u>	<u>eCO₂</u>	<u>%</u>
Buildings	127,528	63%
Transportation	38,620	19%
Streetlights	35,408	18%

*unadjusted

<u>GHGs by Fuel*</u>	<u>eCO₂</u>	<u>% of Total</u>
Electricity	93,302	46%
Natural gas	59,012	29%
Diesel	22,633	11%
Gasoline	15,987	8%
Light Fuel Oil	4,774	2%
Steam	5,677	3%
Propane	171	0.08%

*unadjusted

<u>SCOPE 3</u>	<u>Nat. Gas</u>	<u>Lt. Fuel Oil</u>	<u>Gasoline</u>	<u>Diesel</u>	<u>Electricity</u>	<u>Steam</u>	<u>Subtotal</u>
Boston Housing Authority	59,093	9,561			43,377		112,031
MWRA (Boston share)	841	2,311	368	379	25,850		29,749

FY2007 City of Boston Municipal GHG Emissions - in Equivalent CO₂ Tons

Fiscal Year

<u>Scope 1 And 2 Departments</u>	SCOPE 1				SCOPE 2		<u>Total Dept. eCO₂</u>	<u>% of Total</u>
	Nat. Gas	Lt. Fuel Oil	Gasoline	Diesel	Electricity	Steam		
Arts, Tourism, & Events	-	-	-	-	203	-	203	0%
Boston Public Schools	38,928	-	326	16,077	26,132	-	81,463	40%
Center for Youth and Families	2,495	-	-	-	1,538	-	4,033	2%
Fire	2,977	212	876	2,286	2,414	-	8,765	4%
Graphic Arts	208	-	-	-	84	-	292	0%
Inspectional Services	-	-	-	-	170	-	170	0%
Library	961	227	60	-	7,946	4,919	14,113	7%
Neighborhood Development	-	-	-	-	54	-	54	0%
Parks and Recreation	416	186	416	523	1,816	-	3,357	2%
Police	2,170	411	8,671	-	4,682	-	15,934	8%
Property & Construction Mgmt	645	438	-	-	7,405	1,813	10,301	5%
Public Works	2,166	140	4,792	2,046	1,940	-	11,084	5%
Public Works - Streetlights	4,855	-	-	-	29,673	-	34,528	17%
Transportation	186	70	-	-	258	-	514	0%
Emergency Medical Services	245	-	317	753	206	-	1,521	1%
Public Health Commission	3,125	4,266	-	-	3,675	-	11,066	5%
Water and Sewer Commission	720	-	813	946	2,295	-	4,774	2%
Subtotal	60,097	5,950	16,271	22,631	90,491	6,733	202,173	100%

ADJUSTMENTS and TOTALS

Scope 1 Total	104,949
Scope 1 Adjustments	123
Scope 1 Adjusted Total	104,826
Scope 2 Total	97,224
Scope 2 Adjustments	7,490
Scope 2 Adjusted Total	89,733
Scope 1+2 ADJUSTED TOTAL	194,560

<u>GHGs by Sector*</u>	<u>eCO₂</u>	<u>%</u>
Buildings	128,743	64%
Transportation	38,902	19%
Streetlights	34,528	17%

*unadjusted

<u>GHGs by Fuel*</u>	<u>eCO₂</u>	<u>% of Total</u>
Electricity	90,491	45%
Natural gas	60,097	30%
Diesel	22,631	11%
Gasoline	16,271	8%
Light fuel oil	5,740	3%
Steam	6,733	3%
Propane	198	0.10%

*unadjusted

SCOPE 3

	Nat. Gas	Lt. Fuel Oil	Gasoline	Diesel	Electricity	Steam	Subtotal
Boston Housing Authority	60,547	9,656			41,898		112,101
MWRA (Boston share)	995	5,716	311	367	25,818		33,207

FY2006 City of Boston Municipal GHG Emissions - in Equivalent CO₂ Tons

Fiscal Year

<u>Scope 1 And 2 Departments</u>	SCOPE 1				SCOPE 2		<u>Total Dept. eCO₂</u>	<u>% of Total</u>
	Nat. Gas	Lt. Fuel Oil	Gasoline	Diesel	Electricity	Steam		
Boston Public Schools	35,623	-	215	15,224	26,189	-	77,251	38%
Center for Youth and Families	2,870	-	-	-	2,595	-	5,465	3%
Fire	2,986	232	836	1,739	2,294	-	8,087	4%
Graphic Arts	187	-	-	-	84	-	271	0%
Inspectional Services	-	-	-	-	226	-	226	0%
Library	871	232	59	-	8,338	6,434	15,934	8%
Neighborhood Development	-	-	-	-	49	-	49	0%
Parks and Recreation	466	220	132	559	1,514	-	2,891	1%
Police	2,274	463	8,425	2	5,170	-	16,334	8%
Property & Construction Mgmt	559	444	-	-	7,834	2,206	11,043	5%
Public Works	1,956	151	5,157	2,115	1,607	-	10,986	5%
Public Works Streetlights	4,855	-	-	-	29,972	-	34,827	17%
Transportation	168	89	-	-	272	-	529	0%
Emergency Medical Services	235	-	-	624	137	-	996	0%
Public Health Commission	3,222	5,498	-	-	3,512	-	12,232	6%
Water and Sewer Commission	652	-	766	816	2,259	-	4,493	2%
Subtotal	56,924	7,329	15,590	21,079	92,052	8,640	201,614	100%

ADJUSTMENTS and TOTALS

Scope 1 Total	100,922
Scope 1 Adjustments	31
Scope 1 Adjusted Total	100,891
Scope 2 Total	100,692
Scope 2 Adjustments	6,883
Scope 2 Adjusted Total	93,809
Scope 1+2 ADJUSTED TOTAL	194,700

<u>GHGs by Sector*</u>	<u>eCO₂</u>	<u>%</u>
Buildings	130,118	65%
Transportation	36,669	18%
Streetlights	34,827	17%

*unadjusted

<u>GHGs by Fuel*</u>	<u>eCO₂</u>	<u>% of Total</u>
Electricity	92,052	46%
Natural gas	56,924	28%
Diesel	21,079	10%
Gasoline	15,590	8%
Light fuel oil	7,100	4%
Steam	8,640	4%
Propane	229	0.11%

*unadjusted

SCOPE 3

	Nat. Gas	Lt. Fuel Oil	Gasoline	Diesel	Electricity	Steam	Subtotal
Boston Housing Authority	65,363	10,110			38,747		114,220
Redevelopment Authority	1,648	77			146		1,871
MWRA (Boston share)	865	9,002	326	316	24,807		35,316

FY2005 City of Boston Municipal GHG Emissions - in Equivalent CO₂ Tons

Fiscal Year

<u>Scope 1 And 2 Departments</u>	SCOPE 1				SCOPE 2		<u>Total Dept. eCO₂</u>	<u>% of Total</u>
	Nat. Gas	Lt. Fuel Oil	Gasoline	Diesel	Electricity	Steam		
Boston Public Schools	36,611	-	215	15,202	30,363	-	82,391	39%
Center for Youth and Families	2,877	-	-	-	1,507	-	4,384	2%
Fire	2,577	586	835	1,763	2,406	-	8,167	4%
Graphic Arts	247	-	-	-	84	-	331	0%
Inspectional Services	-	-	-	-	239	-	239	0%
Library	910	196	60	-	8,064	6,559	15,789	8%
Neighborhood Development	-	-	-	-	125	-	125	0%
Parks and Recreation	612	220	226	577	1,522	-	3,157	2%
Police	2,807	593	8,176	1	4,985	-	16,562	8%
Property & Construction Mgmt	497	496	-	-	7,867	3,286	12,146	6%
Public Works	2,387	154	4,794	2,492	1,677	-	11,504	5%
Public Works Streetlights	4,855	-	-	-	31,667	-	36,522	17%
Transportation	216	44	-	-	339	-	599	0%
Emergency Medical Services	245	-	-	470	167	-	882	0%
Public Health Commission	3,015	5,213	-	-	3,768	-	11,996	6%
Water and Sewer Commission	829	-	772	922	2,746	-	5,269	3%
Subtotal	58,685	7,502	15,078	21,427	97,526	9,845	210,063	100%

ADJUSTMENTS and TOTALS

Scope 1 Total	102,692
Scope 1 Adjustments	0
Scope 1 Adjusted Total	102,692
Scope 2 Total	107,371
Scope 2 Adjustments	1,708
Scope 2 Adjusted Total	105,663
Scope 1+2 ADJUSTED TOTAL	208,355

<u>GHGs by Sector*</u>	<u>eCO₂</u>	<u>%</u>
Buildings	137,036	65%
Transportation	36,505	17%
Streetlights	36,522	17%

*unadjusted

<u>GHGs by Fuel*</u>	<u>eCO₂</u>	<u>% of Total</u>
Electricity	97,526	46%
Natural gas	58,685	28%
Diesel	21,427	10%
Gasoline	15,078	7%
Light fuel oil	7,195	3%
Steam	9,845	5%
Propane	307	0.15%

*unadjusted

SCOPE 3

	Nat. Gas	Lt. Fuel Oil	Gasoline	Diesel	Electricity	Steam	Subtotal
Boston Housing Authority	47,097	6,705	420	22	31,625	696	86,565
Redevelopment Authority	1,980	64	850	783	156	-	3,833
MWRA (Boston share)	806	8,969	343	307	24,025	-	34,450

Notes on The City of Boston Municipal Greenhouse Gas Inventories FY2005 to FY2011

In his April 2007 Executive Order Relative to Climate Action, Mayor Thomas Menino directed that the City report annually on its greenhouse gas (GHG) emissions. The City released its first inventories in December 2009. The current report adds fiscal year 2011 (FY11) to the series for municipal operations. It also includes revisions to earlier inventories based on revised data and emission factors. Greenhouse gas emissions from the entire Boston community are described in a separate report.

1. *For more information.* Boston GHG inventories are overseen by staff of the Boston Air Pollution Control Commission (APCC). Please direct any comments or questions about the inventories to Carl Spector, Executive Director, Air Pollution Control Commission, carl.spector@cityofboston.gov.

2. *Inventory protocol.* The overall methodology for calculating GHG emissions relies on the Clean Air and Climate Protection (CACAP) software developed by ICLEI and the National Association of Clean Air Agencies (the City of Boston is a member of both organizations). A new Local Government Operations Protocol for conducting inventories of GHG emissions was adopted by ICLEI, the California Climate Action Registry Board, and the California Air Resources Board in 2008, and by The Climate Registry in 2009. The City of Boston conducts its inventory in general accordance with this protocol, although not in all details.

a. Direct and indirect emissions. The protocol categorizes emissions as direct (Scope 1) or indirect (Scope 2). Direct emissions come from the burning of natural gas, fuel oil, gasoline, diesel fuel, and other fuels in the City's facilities, vehicles, and other equipment. Indirect emissions come from the burning of fuels in facilities owned and operated by others to produce electricity and steam that the City uses.

b. Organizational and operational boundaries. The protocol's Scope 3, "additional emission sources of potential policy relevance," involves the decision of where to place the emissions of the independent and quasi-independent governmental authorities associated with the City of Boston. These include the Boston Housing Authority, the Massachusetts Water Resources Authority, the Boston Public Health Commission (which includes Emergency Medical Services), the Boston Redevelopment Authority, and the Boston Water and Sewer Commission, all of which were included in the original FY00 and FY05 inventories.

Concerning "autonomous departments," the protocol states:

It is often the case that autonomous departments like municipal utilities, ports and airports are managed by their own board of commissioners or executives. If this board is appointed by local government officials (e.g. appointed by the Mayor and confirmed by the City Council) and the local government officials have some level of oversight of the board (e.g. the local government can help guide policy decisions of the department, the actions of the Board can be reviewed and overturned by the City Council, etc.), then the local government is considered to have operational control over the department and should report the emissions associated with the municipal utility/port/airport as part of the local government's GHG inventory. (page 16)

This description applies to the Boston Public Health Commission and the Boston Water and Sewer Commission, whose members and directors are appointed by the mayor and which, therefore, are listed with other City departments. It does not apply to the Massachusetts Water Resources Authority (MWRA),

where the City has three seats out of 11 on the MWRA's board of directors; MWRA emissions are listed in Scope 3.

c. Leased property. The protocol states that a "lessor should not report emissions for assets leased under an operating lease if the lessor is using the operational control consolidation method" (page 19). Although the Boston Housing Authority (BHA) and the Boston Redevelopment Authority (BRA) come under the operational control of the City of Boston (see note 2.b), their emissions, when available, are listed under Scope 3, because the bulk of their emissions come from rental housing and leased industrial and commercial properties. As a practical matter, the BHA, the largest landlord in Boston, with 12,000 rental units, has a large number of programs to reduce energy use and greenhouse gas emissions at its properties. The apparent jump in BHA emissions from 2006 to 2007 is due primarily to improved data collection

3. *Time frame.* The municipal inventory is based on the City's fiscal year, July 1 to June 30, except for data from the Boston Water and Sewer Commission and the Boston Housing Authority, which are based on a calendar year.

4. *Electricity emission factor.* The municipal and community GHG inventories use the electricity emission factor based on the area served by ISO-New England, the regional transmission organization. The ISO-NE electricity emission factor is usually several percent lower than the factor used by the Commonwealth of Massachusetts for the statewide GHG emissions inventory, which is based primarily on power plants located in Massachusetts. Both factors can vary from year to year according to the actual fuel mix used to produce electricity. ISO-NE usually publishes its emission factors about 16 months after the end of the calendar year; therefore, the FY11 electricity-related GHGs are initially calculated with the 2010 emission factor.

5. *Adjustments.* The Adjustments section of the inventory reflects the City's purchases of a biodiesel blend for its diesel vehicles and of Renewable Energy Credits for electricity purchases. Because there remains some disagreement about the proper calculations for the GHG implications of these energy sources, the adjustments are made outside of the Scope 1 and 2 calculations.

a. Biodiesel. In FY06, the City started buying B5, a mixture with 95 percent ultra-low-sulfur diesel and 5 percent biodiesel, for use in many of its diesel vehicles. In the Scope 1 calculation, all the diesel and biodiesel fuels are subject to the same emission factor of 0.0113 tons (22.5 lbs) eCO₂ per gallon. The Scope 1 adjustment assumes that B100 (one hundred percent biodiesel), on the basis of a life-cycle calculation that includes the capture of atmospheric CO₂ during plant growth, has net emissions of only 0.0066 tons (13.3 lbs) eCO₂ per gallon, a 41 percent reduction. (See Hill et al., "Environmental, economic, and energetic costs and benefits of biodiesel and ethanol biofuels," <http://www.pnas.org/content/103/30/11206>, 2006).

b. Renewable Energy Credits (RECs). RECs represent the generation of electricity from renewable energy sources such as wind, solar, and biomass. The City started buying RECs, primarily from Midwestern wind farms, in FY05. The Scope 2 adjustments assume that these sources of electricity have zero GHG emissions and that the appropriate adjustment per megawatt-hour (MWh) is the same as the electricity emission factor. In FY05, the City purchased 3,787 MWh of RECs; in FY06, 15,860 MWh; in FY07, 16,390 MWh; in FY08, 21,530 MWh; in FY09, 20,925 MWh; in FY10, 20,171 MWh; in FY11 21,000 MWh.

6. *Data sources—City Hall departments.* Data on electricity and natural gas purchases by department come from the computer-based Major Vendor System maintained by the Office of Budget Management. The Major Vendor System compiles monthly bills submitted by the City's electricity and natural gas

suppliers. Data on fuel oil use for all departments come from the Purchasing Department's list of invoices received for deliveries or from the fuel vendors themselves. Depending on department, data on gasoline and diesel fuel for vehicles can come from the department itself, the Public Works Department, or the Purchasing Department. Veolia Energy supplies the data on the City's steam consumption as well as an annual emission factor, based on a changing mix of fuels and guidance from the U.S. Energy Information Administration. The annual inventories include some changes from year to year in department names and some consolidation of accounts. For example, in FY11 electricity usage by the Graphic Arts Department was counted under Property and Construction Management. The municipal inventories do not include GHGs associated with official airplane travel nor with employee commuting.

7. *Streetlights.* Most of the City's natural gas streetlights and many of the electric streetlights are unmetered. The bills that the City receives for energy use are based on calculations by the utilities regarding size of pipe, number of hours of darkness, and so on. The GHG emissions for the gas streetlights are based on an average use of 69,000 therms per month.

8. *Boston Public Health Commission.* The BPHC uses propane at one of their facilities. Since 2005 the amount used has dropped steadily, from about 45,000 gallons then, to about 24,000 in FY11. This translates to around 150 pounds of eCO₂, and since this amount is so small, and no other departments use propane, it is accounted for in the natural gas column of the inventory. In FY10, a number of buildings operated by BPHC were remodeled and used significantly less energy while they were unoccupied during construction. In FY11, the remodeled buildings were reoccupied and the overall energy use jumped back up.

9. *Data sources—authorities and commissions.* The five authorities and commissions maintain their own accounts of energy use. They transmitted their annual energy purchases to the APCC, which performed the GHG calculations. Data from the BRA and the BHA are not available for all inventory years.

10. *MWRA allocation.* The Massachusetts Water Resources Authority provides water and sewer services to 2.5 million people and more than 5,500 businesses in 61 communities in eastern and central Massachusetts. At our request, the MWRA allocated to Boston its pro rata share (about 31 percent) of the MRWA total annual energy used based on measurements of actual water and sewer flows.

11. *Revisions.* There were two revisions to previous data. For steam emissions, we had been using the wrong column of numbers provided in a spreadsheet from Veolia, with the result that the previous emission factors were 25-50 percent too low. The other significant change was the incorporation of a new 2010 GHG emission factor for electricity from ISO-NE. This reduced FY10 electricity-related GHGs by about four percent.

12. *Verification.* The City of Boston municipal inventory has not received third-party verification. In general, existing verification frameworks require facility-specific data by calendar year. The City intends to develop the detail of its inventory to this level in the next several years and then obtain verification.

13. *Overall trend.* GHG emissions in FY11 were higher than in FY10. Some of this increase reflects the harder winter in FY11, which had 10 percent more heating-degree days than FY10. Almost all of the GHG increase occurs in fuels used for heating: natural gas, light fuel oil, and steam. GHGs from electricity and gasoline continued their downward trend. Please see [*A Climate of Progress: City of Boston Climate Action Plan Update 2011*](#), page 36, for a discussion of the City's efforts to reduce GHGs from municipal operations.